Tutorial:

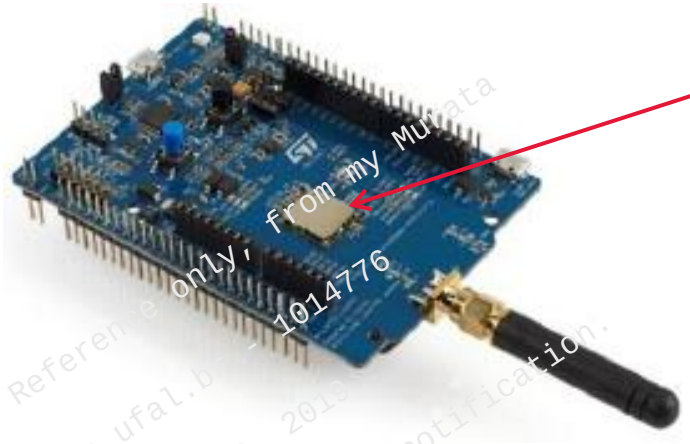
Establishing LoRaWAN with Murata module Type ABZ

March 2018

List of Items

Hardware:

- STMicroelectronics B-L072Z-LRWAN1 LoRa®Discovery kit



Software:

- I-CUBE-LRWAN

  http://www.st.com/en/embedded-software/i-cube-lrwan.html

Tools:

- STM32Cube MCU Package

  http://www.st.com/en/embedded-software/stm32cube-mcu-packages.html?querycriteria=productId=LN1897

- ST-Link Utility

  http://www.st.com/en/development-tools/st-link-v2.html

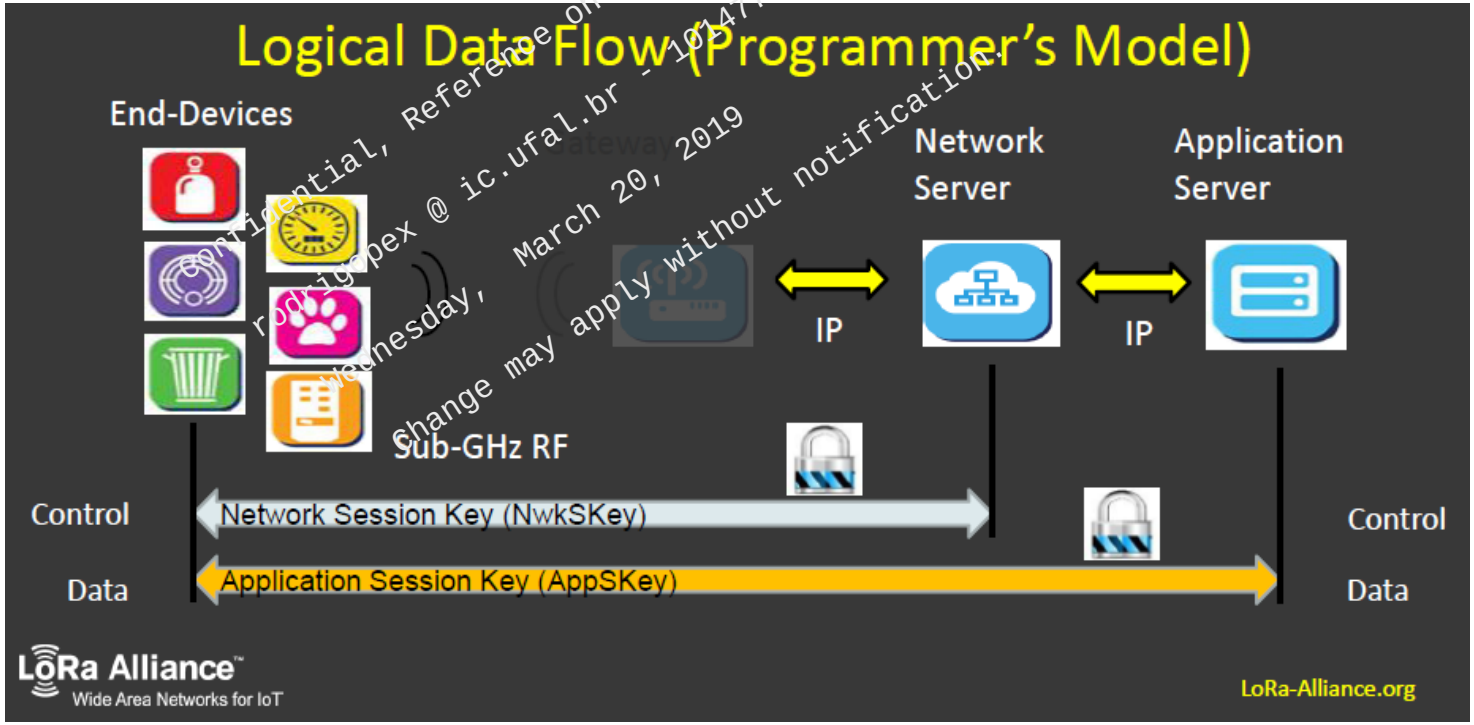
- Partners IDE (KEIL, IAR, Eclipse)

  http://www.st.com/content/st_com/en/support/partners/third-parties-for-mcu-tools.html#3

Advance Preparation

- **DevEUI:**
  - Globally unique identifier for device
  - Need to obtain OUI from IEEE. Then create DevEUI using the certified OUI

- **Network Server/Application Server:**
  - Contact Network/Application server providers and setup your account
  - Alternatively, establish your own Network/Application server



**OUI:* *Organizationally Unique Identifier*

Process Flow

- **Condition:**
  - Network Server: **ThingPark**(*) powered by Actility
  - Activation Method: **OTAA** or **ABP**

  (*) ThingPark Partner web page: *https://partners.thingpark.com/*

- **Process Flow (in the case of OTAA):**

  ① Setup the tools and Firmware

  ② Setup your account in **ThingPark** and get **AppEUI** and **AppKey**

  ③ Build project, configure parameters and flash program to the board

  ④ Register a new device on **ThingPark**

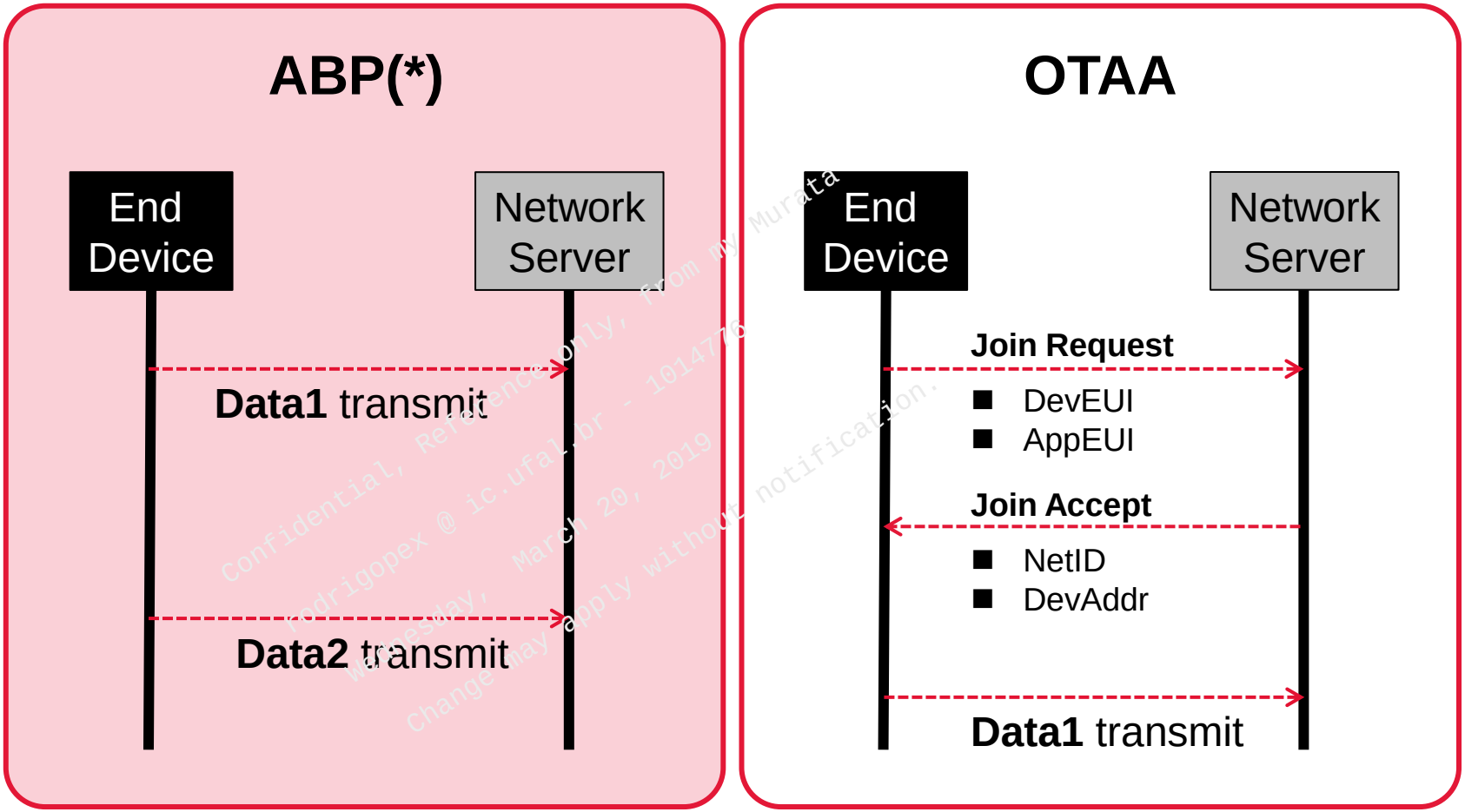
  ⑤ Execute activation process for network commission

  ⑥ Start Uplink/Downlink communication between the board and **ThingPark**

Important Notes:

- *Gateway should be registered on **ThingPark** before starting the above process*

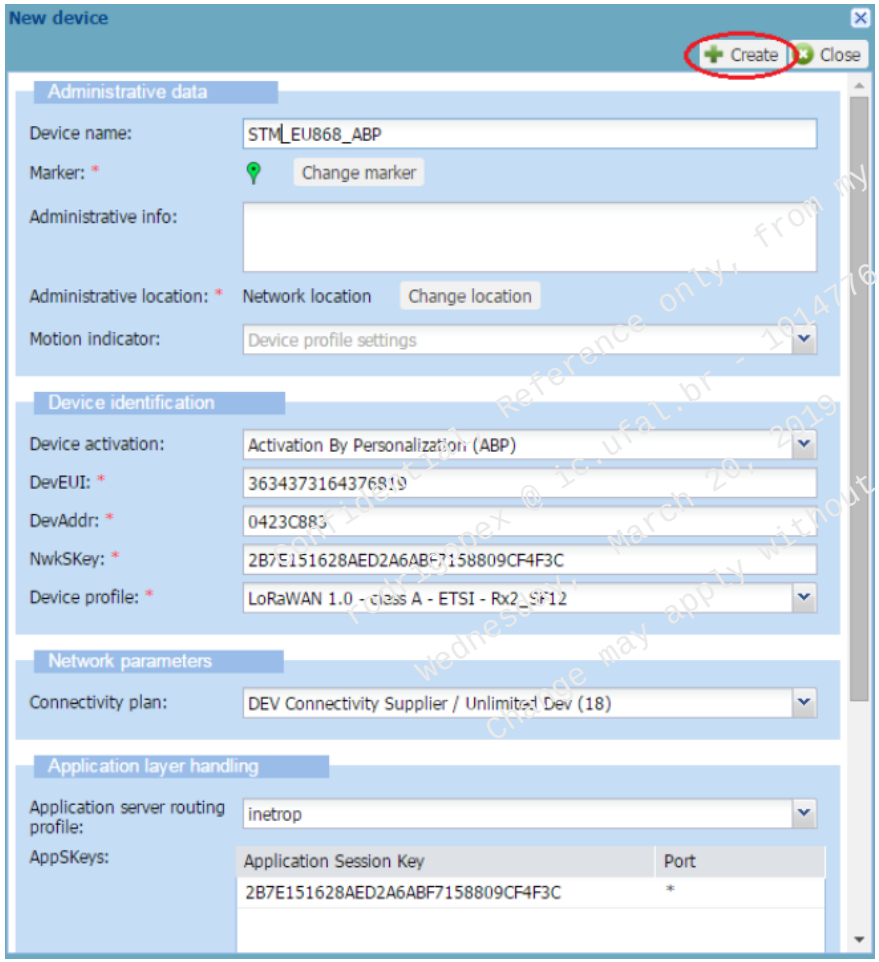
Communication Sequence: ABP vs OTAA



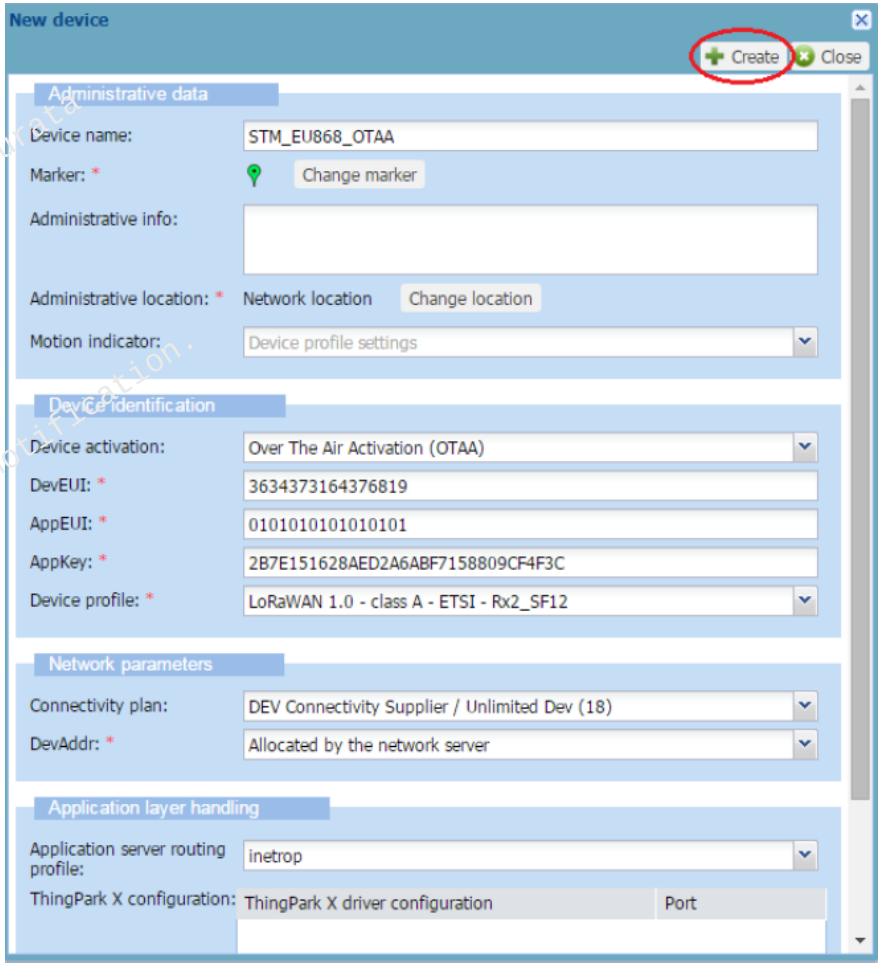
*(*) In case of **ABP**, users are required to set DevEUI, APPEUI, APPSKEY, NWKSKEY, NetID and DevAddr to End Device in advance*

Device Registration: e.g. ThingPark

ABP



OTAA

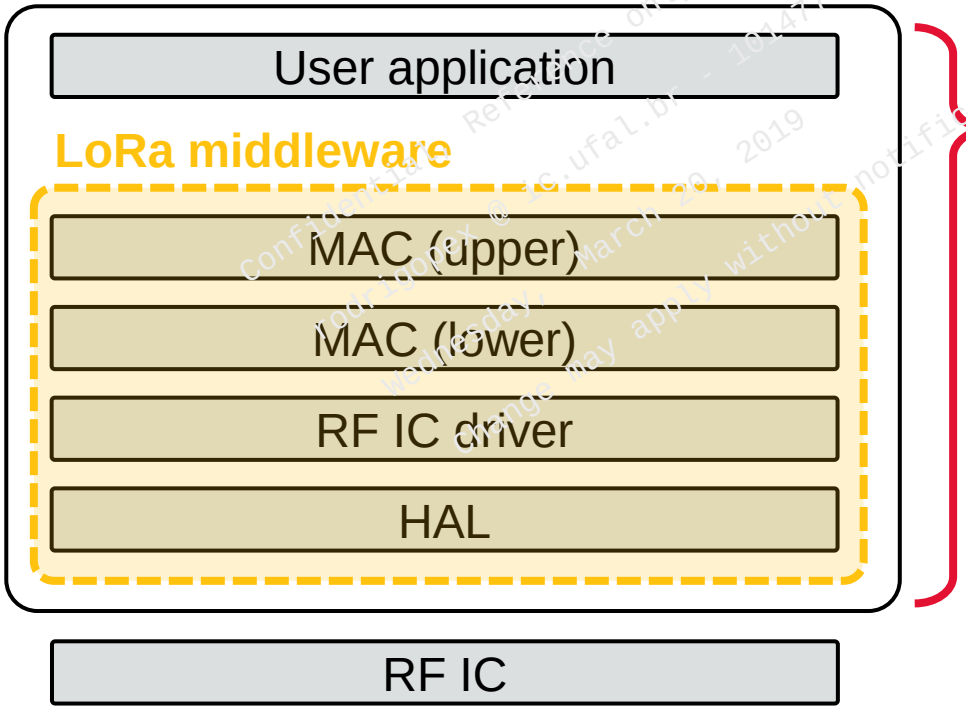


Setup Tools and Firmware

Tools:

- Install ST-Link Utility
- Install Keil MDK-ARM
- Install MDK-ARM device pack

LoRaWAN stack

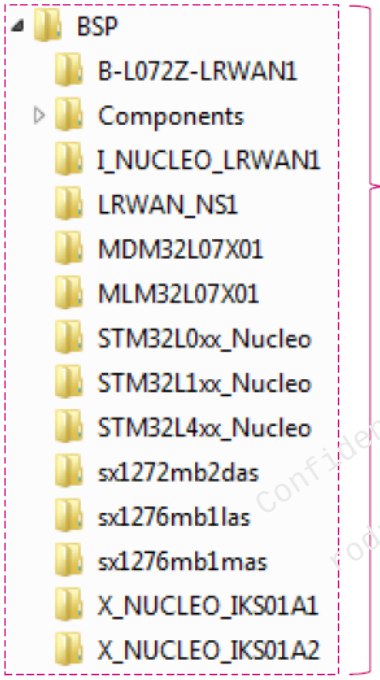


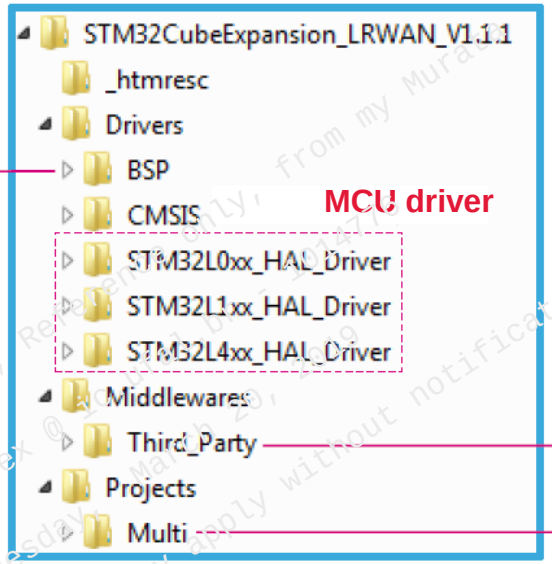
STM32CubeExpansion_LRWAN contains:

- LoRa middleware
- Examples of Application

STM32CubeExpansion_LRWAN:
Project file structure

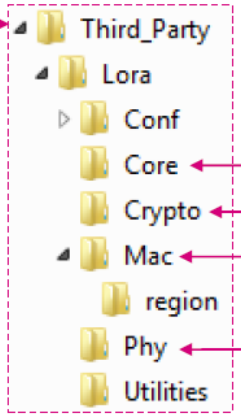
Configuration file





MCU driver

LoRa stack



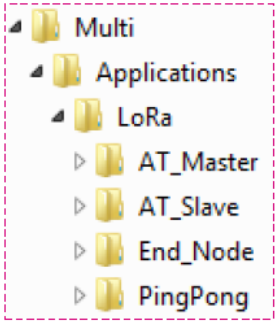
State machine and API

Encryption engine

MAC

PHY interface

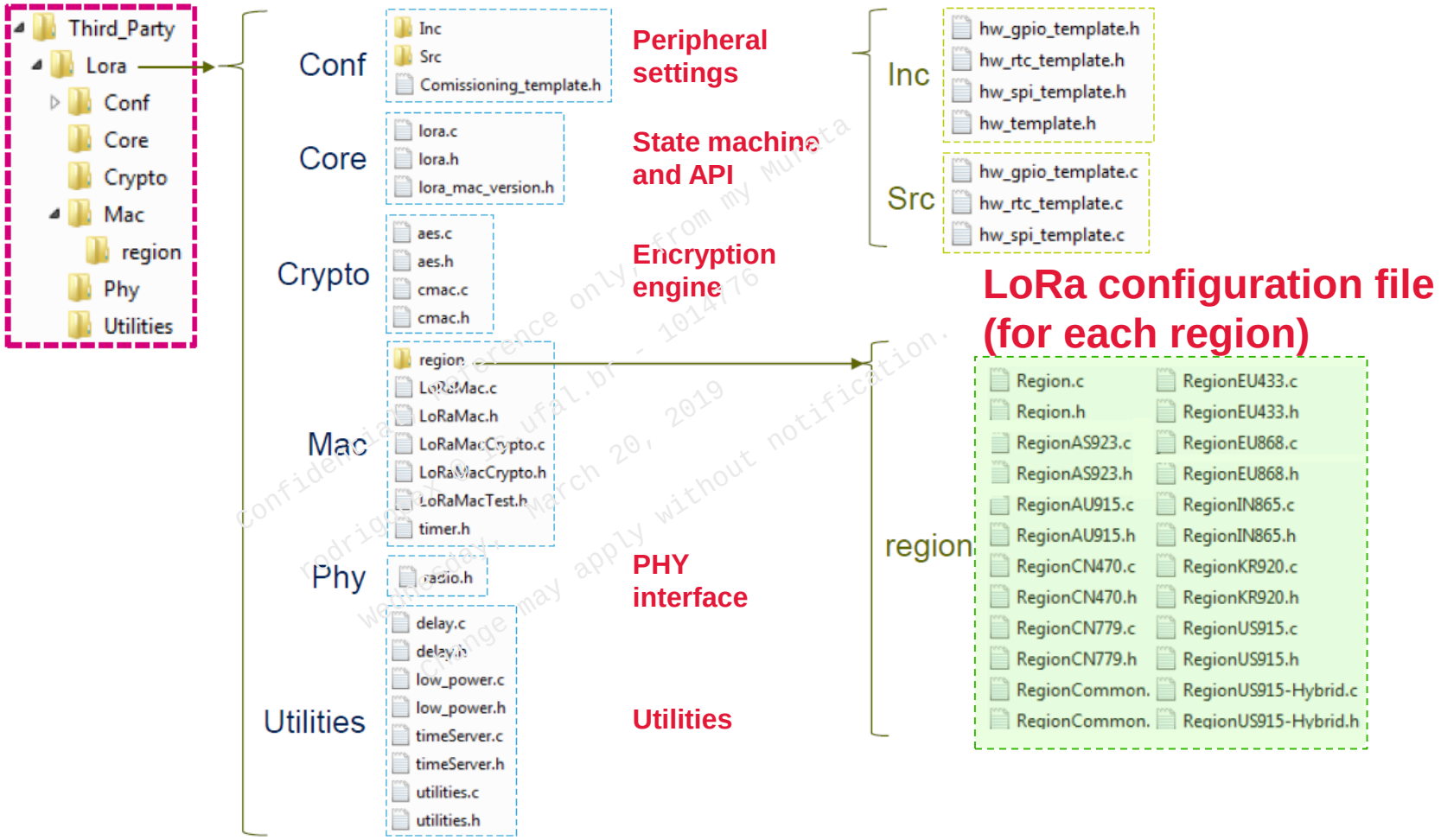
Examples of Application



Project files for each IDE

STM32CubeExpansion_LRWAN

LoRa stack



Main Configuration File (Common)

File	Parameter	ABP/ OTAA	Description
Comissioning.h	OVER_THE_AIR_ACTIVTION	ABP/ OTAA	Select activation method
	STATIC_DEVICE_EUI	OTAA	Select configuration method for **DevEUI**
	LORAWAN_DEVICE_EUI	OTAA	Configure **DevEUI**
	LORAWAN_APPLICATION_EUI	ABP/ OTAA	Configure **AppEUI**
	LORAWAN_APPLICATION_KEY	OTAA	Configure **AppKEY**
	STATIC_DEVICE_ADDRESS	ABP	Select configuration method for **DevAddr**
	LORAWAN_DEVICE_ADDRESS	ABP	Configure **DevAddr**
	LORAWAN_NETWORK_ID	ABP	Configure **NetID**
	LORAWAN_NWKSKEY	ABP	Configure **NetSkey**
	LORAWAN_APPSKEY	ABP	Configure **AppSkey**

Main Configuration File (Regional)

In the case of AS923…

File	Parameter	Description
RegionAS923.h	AS923_NUMB_DEFAULT_CHANNELS	Set the number of channels
	AS923_DEFAULT_DATARATE	Set DataRate (DR=0~7)
	AS923_DEFAULT_MAX_EIRP	Set EIRP
	AS923_LC1, AS923_LC2	Set the channel
	AS923_RSSI_FREE_TH	Set threshold for RSSI Free
	AS_CARRIER_SENSE_TIME	Set duration for carrier sense
	AS923_DEFAULT_TX_POWER	Set default TX Power
	AS923_DEFAULT_UPLINK_DWELL_TIME	Set default uplink dwell time
	AS923_DEFAULT_DOWNLINK_DWELL_TIME	Set default downlink dwell time
	AS923_MAX_NB_BANDS	Set Max Band number

- *Parameters configuration for each region is required*

Parameters Changing (1)

The following parameters can be modified in main.c

- Adaptive Data Rate (ADR)
- Data transmission period
- Message type (Confirmed or Unconfirmed)

ADR (OFF ► ON)

```
84  /*!
85   * Defines the application data transmission duty cycle. 5s, value in [ms].
86   */
87  #define APP_TX_DUTYCYCLE                            10000
88  /*!
89   * LoRaWAN Adaptive Data Rate
90   * @note Please note that when ADR is enabled the end-device should be static
91   */
92  #define LORAWAN_ADR_ON                              0
93  /*!
94   * LoRaWAN confirmed messages
95   */
96  #define LORAWAN_CONFIRMED_MSG                       DISABLE
```

```
84  /*!
85   * Defines the application data transmission duty cycle. 5s, value in [ms].
86   */
87  #define APP_TX_DUTYCYCLE                            10000
88  /*!
89   * LoRaWAN Adaptive Data Rate
90   * @note Please note that when ADR is enabled the end-device should be static
91   */
92  #define LORAWAN_ADR_ON                              1
93  /*!
94   * LoRaWAN confirmed messages
95   */
96  #define LORAWAN_CONFIRMED_MSG                       DISABLE
```

Parameters Changing (2)

The following parameters can be modified in main.c

- Adaptive Data Rate (ADR)
- Data transmission period
- Message type (Confirmed or Unconfirmed)

Data transmission period (30sec ► 60sec)
Message type (Unconfirmed ► Confirmed)

```
84  /*!
85   * Defines the application data transmission duty cycle. 5s, value in [ms].
86   */
87  #define APP_TX_DUTYCYCLE                            10000
88  /*!
89   * LoRaWAN Adaptive Data Rate
90   * @note Please note that when ADR is enabled the end-device should be static
91   */
92  #define LORAWAN_ADR_ON                              1
93  /*!
94   * LoRaWAN confirmed messages
95   */
96  #define LORAWAN_CONFIRMED_MSG                       DISABLE
```

```
84  /*!
85   * Defines the application data transmission duty cycle. 5s, value in [ms].
86   */
87  #define APP_TX_DUTYCYCLE                            60000
88  /*!
89   * LoRaWAN Adaptive Data Rate
90   * @note Please note that when ADR is enabled the end-device should be static
91   */
92  #define LORAWAN_ADR_ON                              1
93  /*!
94   * LoRaWAN confirmed messages
95   */
96  #define LORAWAN_CONFIRMED_MSG                       ENABLE
```

To learn more about Murata's LPWA offerings, please visit:
https://www.murata.com/en-global/products/lpwa?intcid5=com_xxx_xxx_cmn_hd_xxx

For technical details and information, please visit:
https://my.murata.com/en/web/lrwan_abz/home

To purchase Murata module Type ABZ, please check:
https://www.murata.com/support/stock?

To purchase STMicroelectronics B-L072Z-LRWAN1 LoRa®Discovery kit, please check:
http://www.st.com/en/evaluation-tools/b-l072z-lrwan1.html

Enjoy your design journey!